

### ABSTRACT

Apparatus and methods according to the present invention preferably utilize electroosmotic pumps that are capable of generating high pressure and flow without moving mechanical parts and the associated generation of unacceptable electrical and acoustic noise, as well as the associated reduction in reliability. These electroosmotic pumps are preferably fabricated with materials and structures that improve performance, efficiency, and reduce weight and manufacturing cost relative to presently available micropumps. These electroosmotic pumps also preferably allow for recapture of evolved gases and deposited materials, which may provide for long-term closed-loop operation. Apparatus and methods according to the present invention also allow active regulation of the temperature of the device through electrical control of the flow through the pump and can utilize multiple cooling loops to allow independent regulation of the spatial and temporal characteristics of the device temperature profiles. Novel microchannel structures are also described.